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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/697,137	10/30/2003	Jeffrey A. West	TI-36238	9756

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TEXAS INSTRUMENTS INCORPORATED
P O BOX 655474, M/S 3999
DALLAS, TX 75265

EXAMINER

GUERRERO, MARIA F

ART UNIT PAPER NUMBER

2822

DATE MAILED: 06/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/697,137

Applicant(s)

WEST ET AL.

Examiner

Maria Guerrero

Art Unit

2822

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 March 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This Office Action is in response to the amendment filed March 29, 2005.

Status of Claims

2. Claims 1-12 are pending.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-2 and 4-12 are rejected under 35 U.S.C. 102(e) as being anticipated by Zistl et al. (U.S. 6,806,191).

Zistl et al. teaches forming a dielectric layer, forming openings in the dielectric layer, filling the openings with a barrier, a copper seed and an electroplated copper film (Fig. 1a, col. 4, lines 35-67, col. 5, lines 1-5). Zistl et al. shows chemically-mechanically polishing the copper film and gaseously doping the copper film with silicon (copper/silicon film 107) (not copper silicide) (Fig. 1b, 3a, Abstract, col. 5, lines 1-40, col. 6, lines 7-31). Zistl et al. discloses the dielectric layer comprising an interlevel dielectric having vias and an intrametal dielectric having trenches (col. 4, lines 35-55). Zistl et al. teaches doping only a top region of the copper film with silicon by flowing silane at a temperature

of about 350°C to about 420 °C for about 3 to about 10 seconds (col. 5, lines 60-63, col. 6, lines 8-32). Zistl et al. shows the doping as part of a silicon nitride deposition process (Abstract, col. 7, lines 20-40).

4. Zistl et al. teaches transferring the semiconductor body to a chamber, performing the doping by flowing silane for a given time prior striking a plasma in the chamber (Abstract, col. 6, lines 7-10). Zistl et al. shows striking the plasma after flowing the silane for about 3 seconds (at least 0.5 seconds is included) and flowing at least one nitrogen-containing source gas into the chamber to deposit a silicon nitride layer over the copper interconnect (Abstract, col. 6, lines 8-65, col. 7, lines 13-40).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ngo et al. (U.S. 6,211,084).

Ngo et al. teaches forming a dielectric layer, forming openings in the dielectric layer, filling the openings with a barrier, a copper seed and an electroplated copper film (Fig. 1-2, Abstract, col. 5, lines 60-67, col. 6, lines 1-5). Ngo et al. shows chemically-mechanically polishing the copper film and gaseously doping the copper film with silicon (Fig. 1-2, Abstract, col. 6, lines 1-12). Ngo et al. discloses the dielectric layer comprising

an interlevel dielectric having vias and an intrametal dielectric having trenches (Fig. 1-2, col. 1, lines 35-65, col. 5, lines 60-67). Ngo et al. teaches doping only a top region of the copper film with silicon by flowing silane at a temperature of about 250°C to about 350°C for about 1 to about 10 seconds (Fig. 2-3, col. 5, lines 50-60). Ngo et al. shows the doping as part of a silicon nitride deposition process (Fig. 3-4, Abstract, col. 4, lines 48-55, col. 6, lines 10-12).

In addition, Ngo et al. teaches providing a semiconductor body having a trench formed in a dielectric layer at a surface thereof (Fig. 1-2, col. 1, lines 35-65, col. 5, lines 60-67). Ngo et al. discloses forming a copper film over the semiconductor body including the trench (Fig. 1-2, col. 5, lines 60-67). Ngo et al. shows chemically-mechanically polishing the copper film to form a copper interconnect and doping the copper interconnect with silicon (Fig. 1-4, col. 6, lines 1-12).

Regarding claim 3, Ngo et al. does not specifically show the final bulk silicon concentration in the range as claimed. However, Ngo et al. the reaction between copper and silicon forming Cu_xSi_y , wherein $y=1$ and $x=3-5$ (col. 6, lines 18-20).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to specify the range as claimed by routine experimentation because there is not evidence of criticality. "Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990). See MPEP § 716.02 - § 716.02(g).

Response to Arguments

6. Applicant's arguments with respect to claims 1-2 and 4-12 have been considered but are moot in view of the new ground(s) of rejection.

Applicant's arguments filed March 29, 2005 have been fully considered but they are not persuasive. Claim 3 stands rejected because Applicant failed to show evidence of criticality. Applicant does not provide evidence of unexpected results. To establish unexpected results over a claimed range, applicants should compare a sufficient number of tests both inside and outside the claimed range to show the criticality of the claimed range. In re Hill, 284 F.2d 955, 128 USPQ 197 (CCPA 1960). . Applicants must further show that the results were greater than those which would have been expected from the prior art to an unobvious extent, and that the results are of a significant, practical advantage. Ex parte The NutraSweet Co., 19 USPQ2d 1586 (Bd. Pat. App. & Inter. 1991). See MPEP § 716.02 - § 716.02(g).

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within


TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maria Guerrero whose telephone number is 571-272-1837.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 571-272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

June 2, 2005


MARIA F. GUERRERO
PRIMARY EXAMINER